The Fully Burdened Cost of Waste in Contingency Operations

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
MAY 2011		**00-00-2011 to 00-00-2011**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The Fully Burdened Cost of Waste in Contingency Operations	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Army Environmental Policy Institute,1550 Crystal Drive, Suite 1301,Arlington,VA,22202**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 9-12 May 2011 in New Orleans, LA.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**19**	

Background

- The Sustain the Mission Project
- Developed method for calculating the fully burdened cost of fuel and water in theater

Waste Project Purpose

- Method to manage waste in contingency operations
  - Solid, hazardous, and medical waste
- Create a tool for users
- Test the method using the tool

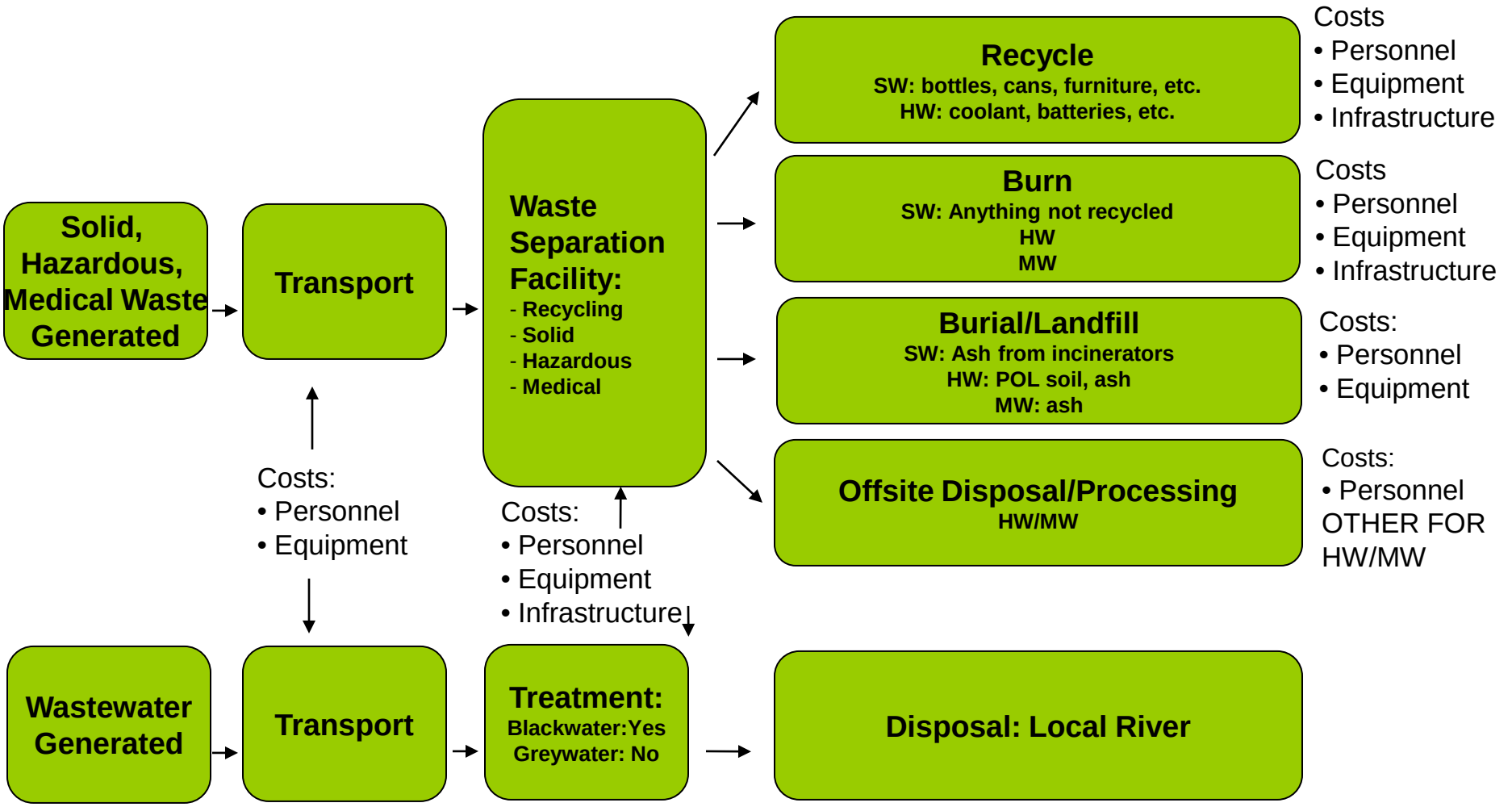
Subject Matter Expert Outreach

- Critical to method development
  - Most of the information came from one-on-one interactions
    - Air Force Central
    - Army Central
    - U.S. Army Corps of Engineers
    - Defense Logistics Agency Disposition Services
    - Central Command
    - Army Medical Command
    - Army Public Health Command

Base Camp Solid Waste Management

Base Types	Basic Self Supported	Expanded Contractor Supported	Enhanced Contractor Supported
Patrol Base	• On-Site Burial • Pack Out		
Command Outpost	• On-Site Open Burn • On-Site Burial	• Waste Collection Area • On-Site Open Burn • On-Site Burial • Off-Site Local Disposal	
Forward Operating Base; Logistics Support Area; Joint Base	• On-Site Open Burn • On-Site Burial	• Waste Collection Area • On-Site Open or Containerized Burn • On-Site Burial • Off-Site Local Disposal	• Segregated Waste Collection Areas (solid, medical, and hazardous) • Recycling Operation for Local Resale Markets • On-Site Reuse/Composting • On-Site Incineration (all types) and/or Containerized Burn (solid) • On-Site Landfills (with liners) • Off-Site Local Solid Waste Disposal • On-Site Hazardous/Medical Waste Preparation for Off-Site Permitted Facility (not local)

Waste Flow


Solid, Hazardous, Medical Waste Generated
Transport
Waste Separation Facility:
- Recycling
- Solid
- Hazardous
- Medical
Recycle
SW: bottles, cans, furniture, etc.
HW: coolant, batteries, etc.
Burn
SW: Anything not recycled
HW
MW
Burial/Landfill
SW: Ash from incinerators
HW: POL soil, ash
MW: ash
Offsite Disposal/Processing
HW/MW
Costs
• Personnel
• Equipment
• Infrastructure
Costs
• Personnel
• Equipment
• Infrastructure
Costs:
• Personnel
• Equipment
Costs:
• Personnel
OTHER FOR HW/MW
Costs:
• Personnel
• Equipment
Costs:
• Personnel
• Equipment
• Infrastructure
Wastewater Generated
Transport
Treatment:
Blackwater:Yes
Greywater: No
Disposal: Local River

Cost Components

Cost Component	Cost Drivers
Infrastructure	Facility type (e.g., waste separation facility, wastewater treatment facility Facility purpose (e.g., utility building that houses both a waste separation facility and a recycling facility)
Personnel	Personnel type (e.g., military, U.S. contractor, third country national, host nation contractor)
Transport and Equipment	Vehicle/equipment type (e.g., dump truck, compactor) Vehicle/equipment quantity Vehicle purpose (e.g., transport of general waste or wastewater) Equipment purpose (e.g., baling, compacting)
Base Closure and Transfer	Exposure to risk of future liability

Base Case: Bagram Air Force Base

Base case: Bagram waste generation	Base case: Bagram waste disposal process
	Recycling facility 15,452 tons annually
Solid waste 39,420 tons annually	Incinerator (air curtain) 18,384 tons annually
	To sewage treatment facility then to river by pipeline 256,230,000 gallon annually
Blackwater 256,230,000 gallons annually	To river 384,345,000 gallons annually
Hazardous waste 2,557 tons annually	Various disposal methods, per regulatory requirements 2,557 tons annually
Medical waste 39.4 tons annually	Incinerator (medi-burns and others) 39.4 tons annually

Estimated Waste Management Costs

Waste Type	Waste generated (annually)	Cost	Bagram Per Person Estimate (~ 27,000)
General waste and wastewater	Solid waste 39,420 tons Blackwater 256,230,000 gallons	$ 17,738,163	$ 657
Hazardous waste	Hazardous waste 2,557 tons	$ 1,791,085	$ 66
Medical waste	Medical waste 39.4 tons	$ 213,920	$ 8
Fully burdened cost of waste (annual)		**$19,743,168**	**$ 731**

Method Demonstration

- Recycle used oil
- Reverse Osmosis Water Purification Units
  - Replacement for bottled drinking water
  - Eliminating bottle waste

Conclusions

- Bagram: bulk of waste management costs are from solid waste; followed by hazardous and then medical waste
  - May not apply to other bases
- Alternative technologies at Bagram
  - Recycled oil savings are inconclusive
  - ROWPU/bottle waste reduction cost savings ~1.5%
  - Cost savings will be base specific
- Lessons learned
  - Need better and additional data
  - Plan for waste early on

Non-Monetary Risks and Liabilities

- Landfills
  - Hazardous leachate
- Incinerator use
  - Exposure to flue gas
  - Hazardous components of fly ash
  - Hazardous emissions from incomplete combustion
- Burn pits
  - Ash and smoke
  - Hazardous emissions from incomplete combustion
- Improper wastewater management
  - Surface water pollution
- Transportation related risks
- Security and diplomatic risks

Recommendations

- Integrate method into contingency base initiative
- Link method to more robust decision-support tools
  - Include the entire sustainable life cycle of materiel use at base camps
  - Use green engineering and green chemistry principles in product design
- Conduct a pilot project
  - Track how the waste moves in time and space at large bases
  - E.g. hazardous waste interim storage
- Incorporate health risks and environmental liabilities
- At Bagram
  - Infrastructure investments to be made

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Backup

Army Strategy for the Environment

- Secretary of the Army and the Chief of Staff established Army-wide Sustainability Policy with the initiation of the Army Strategy for the Environment (ASE)—signed October 1, 2004

- ASE Goals
  - Foster sustainability ethic as an Army value
  - Strengthen Army operational capability
  - Meet current and future training, testing, and other mission requirements
  - Minimize impacts and total ownership costs
  - Enhance well-being
  - Use innovative technology

SMP Background

- In support of ASE Goals, AEPI initiated the Sustain the Mission Project (SMP) in 2005 to develop and demonstrate an analytic methodology for calculating the fully-burdened costs of fuel and water (FBCF/W) resources to sustain Army missions in theaters of operation and the training base
- AEPI developed an alpha SMP Decision Support Tool for evaluating costs and benefits of energy/water technology investments based on FBCF/W
- AEPI conducted an SMP Casualty Factor Study in 2008 to develop casualty factors for resupply convoys (fuel and water) which were incorporated in the alpha SMP Tool

National Defense Authorization Act for FY 2009

- The Secretary of Defense is required
  - To implement a fuel efficient key performance parameter
  - To include in life-cycle cost analysis for new capabilities the fully burdened cost of fuel
  - To consider in analyses and force planning the requirement for, and vulnerability of, fuel logistics

SMP Background

- HQDA G4 Logistics Innovation Agency (LIA) assumed proponency of SMP (Oct 09)
- HQDA G4 initiated a project in 2009 to
  - expand the capabilities of the SMP Tool (energy)
  - distribute the tool for Army-wide use
  - provide training to users
- Army offices began to receive SMP Tool training in 2010 – to include G4, ASA-FM, AMSAA, TRAC, CASCOM, the QM School, TRADOC HQ, Corps of Engineers, PMs, TARDEC, and RDECOM